

The new forms of coming wars demand new methods. But the old methods may be improved, refined, and perfected into novel and better forms. Little will be done about the search for ever more active and toxic war compounds, as was the aim in the World War, since development here has reached a certain limit. The order of magnitude of one gamma, or one-millionth of a gram, which is equal in activity to a milligram for other war compounds, is hardly to be exceeded at present. Among the first considerations, there is no longer the killing, *i. e.*, annihilation, of the opponent, but rather the attainment of the greatest military objective according to the method which gets results. Anticipation, or thwarting, of the enemy's attack is a specially desirable aim. Toward that end, it may be considered that further development will proceed with the known types of green, yellow and blue cross gases. It is to be kept constantly in mind that there is no physical or spiritual function of the human organism which cannot be influenced by chemical means. . . . It would be fatal to accept the fact that the next war will begin where the last one ended. Meantime, there have been going on for decades the most intensive scientific developments in foreign countries, rich in technical progress in all fields. Obviously, the situation in chemical warfare will be an entirely different thing from that in the past. Indeed, we must consider that, in the future, the surprise may come from the other side. Therefore, Germany must work with all her means so she is not eliminated at the first attack, without a battle. For military reasons and self-preservation she must arm herself against surprise. Here is an earnest warning, and also an indication of the coming problem. This can only be solved with the coöperation of science and by pooling of all her resources and methods.

Leave it to the Germans for efficiency, foresight, and thoroughness. All that and more than Professor Flury says will be done. No stone will be left unturned, and there will be surprises for her opponent to assure Germany an early victory. Science, indeed experimental science in all departments, is now, and always has been, at the command of German war strategists for utilization of bigger and better chemical warfare. Could anyone be so naïve as to believe that German dogs and cats will be spared inconveniences of the general staff's methods for preparedness? Let us take heed and profit by the timely warning and allow no one, or nothing, to interfere with preparedness for the future chemical warfare in both defense and offense through animal experimentation.

SOME QUERIES FOR SENTIMENTAL ANTIVIVISECTIONISTS

Finally, and with all due consideration for their human qualities, it may be asked: Do not these sentimental antivivisectionists stultify themselves in the eyes of thinking citizens?

What is their answer to the delectation of their appetites with the flesh of slain animals? Do not they keep their feet and hands warm with shoes and gloves made from the hides of these same animals? What about the protection against and cure of disease among thoroughbred horses, cattle, hogs, poultry, in fact, all domestic animals? Even man's best friend for ages, the faithful dog! How do they justify the commercialized exploitation of confined, miserable wild animals in circuses and menageries? Are they not the cruel beasts, those outside and not within the cages and circus rings, that feast their emotions on exhibited and confined animals?

Perhaps selfish motives will not allow intervention in this and other inhuman conducts. Yet these "antis" stop at nothing to prevent the use of

dogs and other animals in properly conducted scientific experimentation for the alleviation of human and animal suffering. The only consistency in these inconsistent attitudes is the unsportsmanlike conduct of the antivivisectionists.

For their sake, for our sake, and for the sake of all animals, whether in war or in peace, California's proposed "State Humane Pound Act" must not pass!

Stanford University School of Medicine.

THE IMPORTANCE OF THE EMERGENCY TREATMENT OF COMPOUND FRACTURES*

By FREDERIC C. BOST, M.D.
San Francisco

COMPOUND fractures are emergencies of the first order. This fact should be well established in the minds of all physicians and surgeons, for there are in the literature sufficient data to substantiate this statement. That compound fractures are not universally treated as emergencies seems most deplorable. The number of improperly treated cases seen late by clinics and specialists emphasizes the need for constantly bringing this problem before the medical public. Physicians in general cannot possibly realize the tremendous importance of early proper treatment, for, if they did, the common practice of delayed treatment would not be so prevalent. Local infection, general sepsis, gas gangrene, loss of limb, and chronic infection with seriously impaired functional end-results, and loss of life, frequently might be averted if we were all ever alert to the great necessity for immediate and adequate treatment. To bear out these contentions, I should like to cite two incidences:

CASE 1.—I was called to see a boy, age 18, injured in a motorcycle accident some five hours previously. A local fireman had applied a crude wooden gutter splint, had saturated the gaping wounds and projecting tibia and fibula with iodine, and the physician had called a consultant only at the urgent request of the members of the family. It required considerable tact and an unalterable firmness to convince the physician that definitive treatment should not be left until the following morning. By immediate thorough debridement, wound cleansing, fracture reduction, primary wound closure, and proper fixation this patient was saved from innumerable dangerous complications, and the result was eminently satisfactory.

CASE 2.—The second patient, about the same age, presents the opposite and tragic analogue to the first case. This patient was also a victim of a motorcycle accident. His lacerated lower leg, with compound fracture, was immediately dressed by a physician and placed in a pillow splint for twenty-four hours, during which time the foot and lower fragments angulated sharply enough to deprive themselves of all blood supply. The sudden onset of high fever, due to sepsis and gas gangrene infection, called for amputation, but too late to save the victim's life. These two cases represent two extremes; but between them lies a wide field for thought and discussion concerning compound fracture treatment.

* From the Department of Surgery, Orthopedic Division, University of California Medical School and the San Francisco Hospital.

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INITIAL PROCEDURES

The moment of injury initiates the need for prompt and effective treatment. We have all been remiss regarding the immediate handling and transportation of our injured. We leave these important details to untrained or partially trained ambulance attendants, who should and must be taught by us the vast significance of their duties. Hemostasis, wound protection, effective immobilization of injured parts, and swift transportation constitute the first steps in treatment.

The second step, equally important and usually no better handled than the first, is the setting into prompt action of medical and hospital services required by the patient. The physician must be called promptly and respond immediately, for it is he who must survey the wound and the requirements of the patient and supply the measures to combat shock. The physician's services are usually far more easy to obtain than those of the hospital surgery, the x-ray services, and the anesthetist, whose promptness is equally necessary. No matter how prompt the surgeon, his efforts are frequently blocked by the uncoöperation of these accessory services, whose members, unfortunately, can rarely be made to realize the costliness of even momentary delay. Education of his coworkers by the surgeon for a second time becomes paramount.

SUBSEQUENT MEASURES

Third, we must consider the definitive treatment of the wound and the fractures. There is much difference of opinion concerning this stage of treatment. Despite these variations, the principles of treatment remain the same and should be thoroughly understood by all who are called upon to treat the compound fracture. The desired goal is represented by healed skin and soft tissues surrounding a bone in good functional alignment. In general, this requires the following measures:

1. Thorough cleansing preparation of the skin.
2. Rare judgment as to the need of deep-wound cleansing.
3. Thorough debridement of skin edges and soft tissues and bone.
4. Free lavage of the wound.
5. Hemostasis.
6. Reduction of the fracture.
7. Closure or other treatment of the wound.
8. Immobilization of the fracture fragments.
9. Special prophylaxis against infection.

COMMENT

The following discussion concerning these measures is based upon an experience of several years, during which time over 150 cases of compound fractures have been treated at the San Francisco Hospital on the University of California Service. It is thoroughly recognized that no one type of treatment is applicable to all compound fractures, but the general plan may be suited to the individual need.

It should here be stated that the element of time cannot be overemphasized. It is an extremely important factor in that treatment that might be possible during the first few hours after injury may be

entirely impossible later. Also the rigid fixation of fractures during transportation needs reëmphasis, for great additional wound damage may occur between the accident and the appearance of the patient for definitive treatment.

CLEANSING OF THE SKIN

The wound should be covered while hair, grease, and dirt are removed from the surrounding skin areas. Previous to this time we do not believe that the external application of antiseptics is of any value.

DEEP-WOUND CLEANSING

This is a most important step. Many errors may be committed by failure to open what may appear to be a minor skin perforation. Careful inspection and palpation may reveal the softening and boggiess of tissue maceration or of a large hematoma. When in doubt the perforation should be thoroughly opened.

CASE 3.—The case of a male, age 19, injured in an automobile accident stresses this point. He was treated seven hours after injury, and had over the tibial fracture two small puncture wounds, which were bleeding freely. The wounds were merely dressed, and four days postoperatively a massive staphylococcus infection appeared at the fracture site. Thorough drainage, followed by amputation at nineteen days, failed to suffice and the patient expired on the twenty-first day from sepsis and gas gangrene, following an injury which was seen early enough to have been thoroughly debrided and closed.

THOROUGH DEBRIDEMENT

The traumatized wound edges should be sparingly trimmed away, the deep structures of the wound must be thoroughly exposed so all devitalized tissue can be completely excised, including dirty periosteum. The fascial spaces must be thoroughly explored. Loose bone fragments should be mobilized, thoroughly cleansed and left *in situ* to prevent nonunion from loss of bone substance. There is no excuse for failure to enlarge the wound sufficiently to thoroughly expose all of the structures within the damaged area. Without extreme caution tragedies may occur because a potential nidus of infection, however minute, is not exposed.

LAVAGE OF WOUND

The essential factor is free use of fluid for thorough mechanical washing of all the interstices of the wound. The chemical content of the irrigating solution cannot make up for insufficient washing. Tap water and saline are probably as effective as any other solutions. At least a gallon of fluid should be used.

HEMOSTATIS

Vessels of consequence should be ligated with due care that unnecessary ligature and its attendant planting of foreign material be avoided.

REDUCTION OF FRACTURE

Gentleness, and nontraumatic methods are the best insurance against disaster. The reduction should correct angulation, which causes pressure of bone against skin surfaces. The corrected position should be maintained while the limb is being placed in its immobilizing apparatus.

CLOSURE OR OTHER TREATMENT OF WOUND

Wherever possible and within certain arbitrary time limits, we favor the transposition of the compound fracture to a simple fracture by complete wound closure. This closure we effect, even when there is skin loss, by transverse incisions which allow mobilization of skin flaps to cover the traumatized area. Arbitrarily, we have set eight hours as the dead line for primary closure. There may be exceptional instances where closure after a longer time may be employed, but in these instances the relative danger is so high that one should ever be cognizant of the possible complications which might follow such treatment, and be ready to alter the treatment immediately upon their appearance. After eight hours the use of the Orr pack or of frequent wound irrigation is the method of choice. Our results with wound closure within eight hours have yielded a very low percentage of failures. On the other hand, the instance of sepsis in the open treatment has been great. This strengthens our convictions regarding the merit of early treatment, thorough cleansing, and immediate wound closure.

In order to employ this ideal and most simple method, all of the previously mentioned measures must be carefully carried out, and prudent judgment must be exercised.

CASE 4.—For example, a five-year-old boy, who fell six feet, fracturing his radius and ulna, had a small perforated wound over the site of the radius. He was treated eight hours after injury, but the small perforated wound was merely enlarged to four centimeters, a size that did not permit a thorough lavage, and the wound was closed. A very lengthy strenuous and traumatizing attempt at reduction followed wound closure. The day following surgery he had a sharp febrile rise and developed gas gangrene involving all the muscles of the forearm. Neither serum therapy nor open debridement saved the arm from amputation.

This patient's treatment was delayed for five hours while hospital authorities were trying to contact his parents. The debridement was insufficient and the wound closure and the fracture treatment disastrous. Any of these factors or a combination of them might have been responsible for the end-results.

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CASE 5.—A second case illustrates the inadvisability of attempting to save a limb when there is too much primary damage. This man, age 48, was struck by falling lumber. He had extensive skin lacerations, and when the wounds were debrided three hours after injury they showed massive muscle pulverization. The wound was debrided thoroughly and treated by Dakinization, but circulation failure and sepsis resulted in the patient's death. Primary amputation with either open or closed flaps very likely would have saved his life.

IMMOBILIZATION OF FRACTURE FRAGMENTS

In our case series we have employed internal fixation only twice. In both instances the wound was closed primarily and no untoward results occurred. These were carefully chosen cases treated early. We do not generally favor internal fixation, but fully realize it can be used with the Orr pack or other open methods.

External fixation by means of pin traction with the pin far removed from the site of fracture, or a plaster cast with or without pin fixation, have been the most satisfactory methods used by us. In some of the earlier cases four pin-fixation methods had been used. This usually means that pins may be

in close proximity to the fracture and, in fact, four cases treated by this method resulted in infection and chronic sepsis.

SPECIFIC PROPHYLAXIS

Routinely, our cases have been given 1500 units of antitetanic serum.

We have not used gas gangrene antisera routinely, but in badly macerated cases have given a therapeutic dose of 20,000 units at once and have repeated this frequently if we felt it necessary.

IN CONCLUSION

The purpose of this presentation has been to make a plea for the recognition of the compound fracture as an emergency. I have attempted to point out the importance of the early and the immediate treatment of the compound fracture. I have stated in detail what I consider the important steps in the adequate treatment of such fractures, and have called attention to some of the complications which may occur when important principles are neglected.

384 Post Street.

INTRATRACHEAL INSTILLATION OF LIQUID PETROLATUM: PULMONARY INJURY THEREFROM*

By GEORGE HAMILTON HOUCK, M.D.
Los Angeles

DISCUSSION by Dean E. Godwin, M.D., Long Beach.

FOR almost fifty years certain inflammatory lesions of the respiratory tract have been treated by some physicians with intratracheal instillations of warm liquid petrolatum, usually containing small quantities of camphor and menthol. Little attention was given to the pathogenic potentialities of oil within the lungs until about ten years ago, and even then the lung injuries which aroused the interest of the pathologist were due to the accidental aspiration of oils in young and debilitated infants. A smaller number of cases of fatal lung injury due to oil have been reported in adults. One patient¹⁶ aspirated butterfat because of cardiospasm, and in another⁹ the source of the mineral oil was not known. Laughlen's patient,¹¹ who had a laryngeal paralysis, was given nasopharyngeal instillations of mineral oil. Other adults^{1, 3, 5, 15} were the victims of prolonged self-medication with large amounts of mineral oil used by nasal instillation.

TERMINOLOGY

No satisfactory terminology for this pathological process has developed. The primary acute reaction has been called lipoid pneumonia.¹⁴ Ikeda^{9, 10} has recently suggested the term "oil aspiration pneumonia." This disease, which is most frequently seen in the infant, is terminal as a rule; but an occasional adult survives, and the major portion of the pathological change is then due to the slowly developing fibrosis. This has been termed "pulmonary induration," "pulmonary contraction,"³ "pulmo-

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